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BULLETIN OF COURSES, JANUARY 1968 TO JULY 1969, NATIONAL CENTER FOR RADIOLOGICAL HEALTH, TRAINING AND MANPOWER DEVELOPMENT PROGRAM

National Center for Radiological Health
Rockville, Maryland

1969

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National Center for Radiological Health Training Courses

1968 - 1969

NATIONAL TECHNICAL INFORMATION SERVICE

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service

BULLETIN of COURSES
January 1968 to July 1969

National Center for Radiological Health

Training and Manpower Development Program

Rockville, Maryland 20852

I

Public Health Service Publication No. 1633 Revised

Foreword

The National Center for Radiological Health is the arm of the Public Health Service responsible for a national program to prevent and control radiation hazards so that the Nation may derive the fullest possible benefits from radiation with the least health risk. The Center fulfills its mission through human epidemiologic surveys, environmental surveillance, research and development, technical assistance, training and manpower development, and consultation on national and international programs.

Within the National Center for Radiological Health, the Training and Manpower Development Program is responsible for developing training systems needed for the nation's radiological health programs. It supports work in educational institutions through grants and contracts; produces training publications and audiovisual aids; and offers technical training services such as short courses, consultation and assistance to States and others in meeting on-the-job training needs. Course manuals and other teaching materials are prepared to strengthen radiological health training in many fields.

Technical training in the principles and techniques of radiation protection and control is provided those engaged in the use of radiation through one- or two-week courses, bench training, and advanced seminars. Courses are given at Center headquarters in Rockville, Maryland, and at Regional Radiological Health Laboratories in Las Vegas, Nevada; Winchester, Massachusetts; and Montgomery, Alabama. Upon request, field courses are scheduled in other locations for special groups.

Our training goal is to give health personnel an appreciation and awareness of the effects of radiation exposure on the individual and the general population as well as the medical and industrial benefits to be derived from the most efficient use of radiation. We will have achieved this goal if our efforts contribute to professional and public knowledge, leading to the desired balance between radiation hazards and benefits.

James G. Terrill, Jr.

James G. Terrill, Jr.
Director, National Center
for Radiological Health

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INFORMATION FOR APPLICANTS

Technical Courses

Technical courses in radiological health of one to two weeks' duration are held at the National Center for Radiological Health in Rockville, Maryland, at Regional Laboratories at Las Vegas, Nevada; Winchester, Massachusetts; and Montgomery, Alabama; and at selected field sites. The courses provide intensive training in radiological health and in specific, job-related areas. Training is on a graduate level with the exception of certain courses for technicians, such as those in X-ray technology.

Courses are planned and conducted by a full-time staff of specialists in radiological health. Guest lecturers and consultants from other Government agencies, universities and industry contribute their specialized knowledge and experience. Lectures, audiovisual aids, demonstrations and laboratory exercises are used. Students solve situational problems and participate in panel discussions to relate course content to their own experience.

Special Services

Staff members of the Technical Training Services provide consultation and training assistance to State and local health departments, universities and other appropriate agencies in meeting training needs. When indicated, the training staff will develop and present special courses or seminars in cooperation with the requesting agency. Such courses incorporate and demonstrate the practical applications of the newest scientific and research developments and techniques. Requests for such training may be submitted through the Regional Representative for Radiological Health in the Regional Offices, or through the Chief, Technical Training Services, National Center for Radiological Health, Rockville, Maryland 20852. Regional office locations are listed on page 3.

Trainee Requirements

Courses are designed primarily for professional personnel in radiological health programs who are responsible for the control of radiation hazards. Because of the technical nature of the courses, trainees should have at least a baccalaureate degree in a science or equivalent preparation. This requirement does not apply to technician courses.

There is no tuition or registration fee; however, the trainee or his sponsoring agency is responsible for transportation costs and subsistence while attending the course.

Applications

Application forms can be found at the back of this brochure. Because courses are conducted by four Training Sections, the application should be sent to the one indicated (by the number in parentheses) after each specific course as designated in the Chronological Schedule on pages 4-6. The complete addresses of the Training Sections are on page 6. Early application is advised since courses are usually oversubscribed.

Applicants will receive information on local transportation, living accommodations and course details when they receive confirmation of acceptance in a course.

PUBLIC HEALTH SERVICE REGIONAL OFFICES

REGION	AREAS INCLUDED	ADDRESS AND TELEPHONE NUMBER
I	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont	John Fitzgerald Kennedy Federal Building Boston, Massachusetts 02203 Tel: 223-6869
II	Delaware, New Jersey, New York, Pennsylvania	Federal Building 26 Federal Plaza New York, New York 10007 Tel: 264-2513
III	District of Columbia, Kentucky, Maryland, N. Carolina, Virginia, West Virginia, Puerto Rico, Virgin Islands	220 Seventh Street, NE Charlottesville, Virginia 22901 Tel: 296-5171
IV	Alabama, Florida, Georgia, Mississippi, South Carolina, Tennessee	Room 404, 50 Seventh Street, NE Atlanta, Georgia 30323 Tel: 526-5214
V	Illinois, Indiana, Michigan, Ohio, Wisconsin	Room 712 New P. O. Building 433 West Van Buren Street Chicago, Illinois 60607 Tel: 353-5264
VI	Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, South Dakota	601 East 12th Street Kansas City, Missouri 64106 Tel: 374-3307
VII	Arkansas, Louisiana, New Mexico, Oklahoma, Texas	1114 Commerce Street Dallas, Texas 75202 Tel: 749-2225
VIII	Colorado, Idaho, Montana, Utah, Wyoming	Room 9017 Federal Office Building 19th and Stout Streets Denver, Colorado 80202 Tel: 297-4457
IX	Alaska, Arizona, California, Hawaii, Nevada, Oregon, Washington, Guam, American Samoa	50 Fulton Street San Francisco, California 94102 Tel: 556-2211

Inquiries should be made to the Regional Representative for Radiological Health, PHS, DHEW, at the address or phone number shown.

CHRONOLOGICAL SCHEDULE OF COURSES

National Center for Radiological Health
Training and Manpower Development Program

Date	Title	Location*
1968		
Jan. 8 - Jan. 19	Basic Radiological Health	Rockville, Md. (1)
Jan. 8 - Jan. 19	Measurement of Airborne Radioactivity	Winchester, Mass. (3)
Jan. 15 - Jan. 26	Occupational Radiation Protection	Las Vegas, Nev. (2)
Jan. 15 - Jan. 26	Basic Radiological Health	Montgomery, Ala. (4)
Jan. 22 - Jan. 26	Radiological Health for Pharmacists	Rockville, Md. (1)
Feb. 5 - Feb. 16	Medical X-ray Protection	Rockville, Md. (1)
Feb. 5 - Feb. 9	Introduction to Automatic Data Processing Systems	Las Vegas, Nev. (2)
Feb. 12 - Feb. 23	Basic Radiological Health	Cincinnati, Ohio (3)
Feb. 26 - March 1	Introduction to Automatic Data Processing Systems	Rockville, Md. (1)
March 4 - March 15	Radionuclide Analysis by Gamma Spectroscopy	Las Vegas, Nev. (2)
March 18 - March 29	Programming for the IBM 1620 Computer	Rockville, Md. (1)
March 18 - March 29	Occupational Radiation Protection	Montgomery, Ala. (4)
March 25 - April 5	Chemical Analysis of Environmental Radionuclides	Winchester, Mass. (3)
March 25 - April 5	Medical X-ray Protection	Las Vegas, Nev. (2)
April 1 - April 12	Basic Radiological Health	Rockville, Md. (1)
April 22 - May 3	Reactor Safety and Hazards Evaluation	Rockville, Md. (1)
April 22 - May 3	Operational Aspects of Radiation Surveillance	Cincinnati, Ohio (3)
April 22 - May 3	Basic Radiological Health	Las Vegas, Nev. (2)
May 6 - May 10	Radiological Health for Nurses	Rockville, Md. (1)
May 13 - May 24	Basic Radiological Health	Albany, N.Y. (1)
May 13 - May 24	Occupational Radiation Protection	Rockville, Md. (1)
May 13 - May 24	Radionuclide Analysis by Gamma Spectroscopy	Winchester, Mass. (3)
May 13 - May 24	Basic Radiological Health	Austin, Texas (2)
June 3 - June 7	Management of Radiation Accidents	Albany, N.Y. (1)

*The number following the location indicates the address to which the application should be sent. The complete address is shown on page 6.

CHRONOLOGICAL SCHEDULE OF COURSES (Cont'd)

Date	Title	Location
1968		
June 3 - June 14	Basic Radiological Health	Cincinnati, Ohio (1)
June 3 - June 14	Basic Radiological Health	Winchester, Mass. (3)
July 8 - July 19	Operational Aspects of Radiation Surveillance	Winchester, Mass. (3)
July 15 - July 26	Basic Radiological Health	Montgomery, Ala. (4)
July 22 - Aug. 2	Medical X-ray Protection	Rockville, Md. (1)
July 29 - Aug. 2	Management of Radiation Accidents	Winchester, Mass. (3)
Aug. 12 - Aug. 23	Basic Radiological Health	Las Vegas, Nev. (2)
Aug. 26 - Aug. 30	Introduction to Automatic Data Processing Systems	Rockville, Md. (1)
Sept. 9 - Sept. 20	Occupational Radiation Protection	Austin, Texas (4)
Sept. 16 - Sept 27	Basic Radiological Health	Winchester, Mass. (3)
Sept. 23 - Oct. 4	Medical X-ray Protection	Montgomery, Ala. (4)
Sept. 30 - Oct. 11	Occupational Radiation Protection	Las Vegas, Nev. (2)
Oct. 14 - Oct. 25	Basic Radiological Health	Rockville, Md. (1)
Oct. 14 - Oct. 25	Radionuclide Analysis by Gamma Spectroscopy	Winchester, Mass. (3)
Oct. 21 - Nov. 1	Basic Radiological Health	Las Vegas, Nev. (2)
Oct. 28 - Nov. 8	Occupational Radiation Protection	Rockville, Md. (1)
Nov. 4 - Nov. 8	Radiological Health for X-ray Technologists	Winchester, Mass. (3)
Nov. 18 - Nov. 22	Measurement of Airborne Radioactivity	Winchester, Mass. (3)
Dec. 9 - Dec. 13	Management of Radiation Accidents	Montgomery, Ala. (4)
Dec. 9 - Dec. 20	Chemical Analysis of Environmental Radionuclides	Winchester, Mass. (3)
Dec. 16 - Dec. 20	Radiological Health for X-ray Technologists	Rockville, Md. (1)
1969		
Jan. 6 - Jan. 17	Basic Radiological Health	Montgomery, Ala. (4)
Jan. 13 - Jan. 24	Occupational Radiation Protection	Las Vegas, Nev. (2)
Jan. 13 - Jan. 24	Basic Radiological Health	Winchester, Mass. (3)
Jan. 20 - Jan. 24	Introduction to Automatic Data Processing Systems	Rockville, Md. (1)
Feb. 3 - Feb. 14	Basic Radiological Health	Las Vegas, Nev. (2)

CHRONOLOGICAL SCHEDULE OF COURSES (Cont'd)

Date	Title	Location
1969		
Feb. 3 - Feb. 14	Operational Aspects of Radiation Surveillance	Montgomery, Ala. (4)
Feb. 24 - Mar. 7	Basic Radiological Health	Rockville, Md. (1)
Feb. 24 - Mar. 7	Radionuclide Analysis by Gamma Spectroscopy	Las Vegas, Nev. (2)
Feb. 24 - Mar. 7	Occupational Radiation Protection	Montgomery, Ala. (4)
Mar. 10 - Mar. 21	Medical X-ray Protection	Rockville, Md. (1)
Mar. 24 - Apr. 4	Occupational Radiation Protection	Rockville, Md. (1)
Apr. 14 - Apr. 25	Reactor Safety and Hazards Evaluation	Rockville, Md. (1)
Apr. 14 - Apr. 25	Basic Radiological Health	Las Vegas, Nev. (2)
Apr. 14 - Apr. 25	Radionuclide Analysis by Gamma Spectroscopy	Winchester, Mass. (3)
Apr. 28 - May 9	Medical X-ray Protection	Las Vegas, Nev. (2)
Apr. 28 - May 9	Basic Radiological Health	Albany, N. Y. (3)
May 5 - May 9	Radiological Health for Nurses	Rockville, Md. (1)
May 12 - May 23	Basic Radiological Health	Austin, Texas (2)
June 2 - June 13	Basic Radiological Health	Rockville, Md. (1)
June 2 - June 13	Occupational Radiation Protection	Winchester, Mass. (3)
June 23 - July 4	Radionuclide Analysis by Gamma Spectroscopy	Winchester, Mass. (3)

Mail application to appropriate Section listed below:

1. Chief, Rockville Radiological Health Training Section
   National Center for Radiological Health
   Rockville, Maryland 20852

2. Chief, Southwestern Radiological Health Training Section
   Southwestern Radiological Health Laboratory
   P.O. Box 15027
   Las Vegas, Nevada 89114

3. Chief, Northeastern Radiological Health Training Section
   Northeastern Radiological Health Laboratory
   109 Holton Street
   Winchester, Massachusetts 01890

4. Chief, Southeastern Radiological Health Training Section
   Southeastern Radiological Health Laboratory
   P.O. Box 61
   Montgomery, Alabama 36101

COURSE DESCRIPTIONS

BASIC RADIOLOGICAL HEALTH (211)*

2 weeks

This course provides professional health personnel with the basic technical knowledge essential to radiological health work. It is prerequisite to the courses Occupational Radiation Protection (212), Chemical Analysis of Environmental Radionuclides (240), Radionuclide Analysis by Gamma Spectroscopy (208), Measurement of Airborne Radioactivity (251), Reactor Safety and Hazards Evaluation (223), Management of Radiation Accidents (235), and Operational Aspects of Radiation Surveillance (236).

The course covers the basic nuclear physics necessary for an understanding of the technical aspects of radiological health problems in public health. It discusses in detail the major sources of radiation exposure, modes of radiation injury, and quantitative units and terminology used in this field. Existing standards for radiation protection are discussed. In the evaluation of specific problems, emphasis is placed on the use, operation, and calibration of laboratory and field-survey instruments. Approximately one-third of the scheduled time is devoted to problem and laboratory sessions. Agenda items include:

- Sources of radiation exposure
- Atomic structure and radioactivity
- Radioactive decay
- Interaction of radiation with matter
- Biological effects
- Radiation protection guides
- Principles of radiation detection
- Principles of radiation protection
- Survey and personnel monitoring instruments
- Laboratory counting instruments
- Assay of beta and gamma emitters
- Nuclear reactions, including fission and fusion
- Control of radioactive materials

RADIOLOGICAL HEALTH FOR NURSES (203)*

1 week

This course provides nurses with a knowledge of the fundamentals of radiation, its biological effects, medical uses and nursing implications, and the principles of radiation protection. It assumes no previous knowledge of radiological health. Included in the course are laboratory sessions on patient protection, patient monitoring, handling of radioactive materials, and use of personnel survey and laboratory counting instruments. Topics discussed in lectures and group discussions include:

- Atomic structure and radioactivity
- Production and properties of X rays
- Units of radiation dose
- Personnel monitoring and survey instruments
- Biological effects of ionizing radiation
- Hazards associated with the use of radiation
- Principles of radiation protection
- Radiation protection guides
- Clinical applications of radiation
- Nursing responsibilities
- Radioisotope accidents and their management

*These courses are available for field presentation. The dates and locations are to be negotiated by the requesting agencies through the appropriate PHS Regional Office. Addresses of Regional Offices are listed on page 3.

RADIOLOGICAL HEALTH FOR X-RAY TECHNOLOGISTS (246)*

1 week

This course is designed specifically for instructors and supervisors of X-ray technologists. Its aim is to strengthen their teaching and practice of X-ray protection and prepare them to incorporate broader radiological health content into the X-ray technology curriculum.

Because medical and dental X rays now comprise the largest source of man-made radiation exposure to the population, efforts are being directed toward devising methods of reducing such exposure to a minimum consistent with good medical practice. The X-ray technologist, through the practice of safe techniques, is in a position to reduce unnecessary exposure to both patients and personnel. This course is intended to provide him with the knowledge needed to accomplish this goal, through demonstrations and laboratory exercises on patient protection, scattering of X rays, and survey of X-ray equipment. It includes:

- Fundamentals of radiation
- Properties and production of X rays
- Radiation detection and measurement
- Biological effects of radiation
- Principles of radiation protection
- Radiation protection guides
- Reduction of exposure to X-ray technologists and patients

MEDICAL X-RAY PROTECTION (213)*

2 weeks

Because of the significance of medical and dental X rays as a principal source of radiation exposure to the total population, a 2-week course has been developed for professional public health personnel who are directly responsible for X-ray surveys and related radiation control programs.

The instruction, presented in lectures, laboratories, and group discussions, stresses protection of both patient and operator in the use of X rays and how this can be accomplished. Emphasis is given to survey techniques used in the inspection of medical and dental X-ray installations. Opportunity is provided for the trainee to conduct inspections of various X-ray units. The principles of coning and filtration and the measurement of scattered dose are demonstrated with phantoms. The topics covered include:

- Fundamentals and sources of radiation
- Biological effects of exposure to radiation
- Principles of radiation protection
- Production and properties of X rays
- X-ray circuits and components
- Clinical radiological procedures
- Reduction of exposure to the patient
- Dental X-ray protection
- X-ray shielding design
- Response time and energy dependence of survey instruments
- Procedures for inspection and survey of X-ray installations
- Physical properties and use of high-speed radiographic film
- Radiation protection guides
- Public health aspects of exposure to radiation

RADIOLOGICAL HEALTH FOR PHARMACISTS (218)*

1 week

This course acquaints pharmacists with the basic concepts of radiological health and the health problems associated with the use of ionizing radiation. It also provides the hospital pharmacist with a background of technical knowledge concerning the potential hazards and protective measures required in the use of radiopharmaceuticals in clinical practice. The course includes:

- Sources of radiation exposure
- Review of radiation fundamentals
- Biological effects of radiation
- Radiation protection guides
- Principles of radiation detection and protection
- Survey and personnel monitoring instruments
- Medical and industrial uses of radiation
- Licensing of radiopharmaceutical users
- Hospital radioisotope facilities and equipment

OCCUPATIONAL RADIATION PROTECTION (212)*

2 weeks

This course is intended for industrial hygienists, health physicists, and other professional personnel concerned with in-plant radiological health problems. The course Basic Radiological Health (211), or equivalent training, is prerequisite.

Major emphasis is placed on evaluation of external and internal exposure to radionuclides and methods for protection against these hazards. Neutron sources and machine-produced radiation, exclusive of medical X rays, are considered as well as special problems associated with nuclear emergencies. Medical X-ray protection is of such importance, from the operator and patient-exposure viewpoint, that a separate course (213) is devoted exclusively to it. Approximately one-third of the course is devoted to laboratory exercises. Agenda topics include:

- Sealed sources in medicine and industry
- Beta and gamma shielding design
- Leak testing of sealed sources
- Laboratory design
- Contamination monitoring and decontamination
- Sampling, counting, and control of airborne radioactivity
- Disposition of radioactive wastes
- Industrial X-ray protection
- Neutron instrumentation, protection and biological effects
- Miscellaneous sources of X rays
- Particle acceleration hazards
- Transportation accidents and regulations
- Emergency exposure and concentration guides
- Emergency planning and management
- Evaluation of radiation exposures
- Regulatory and administrative aspects

REACTOR SAFETY AND HAZARDS EVALUATION (223)

2 weeks

This course is designed to provide an appreciation of the public health aspects of nuclear facility operation to personnel of public health agencies, nuclear industries, and military reactor installations. Because of its advanced nature, a degree in science or engineering and the course Basic Radiological Health (211), or equivalent training, is necessary.

Principal areas covered are: reactor fundamentals, engineered safeguards, design safety analysis, development of emergency plans, and environmental surveillance. Major emphasis will be given to power reactors of the pressurized-water and boiling-water types. Field trips will be made to selected reactors in the area. Trainees will have the opportunity to review and devise both on- and off-site emergency plans. Groups will discuss specific problems. Lecture topics include:

- Principles of reactor operation and control
- Instrumentation and safety mechanisms
- Site selection
- Containment
- Environmental analysis
- Waste management
- Dose calculations
- Analysis of past accidents
- Fuel reprocessing
- Licensing and regulations

RADIUM HAZARDS AND CONTROL (241)*

1 week

Radium presents a special public health problem because its unique physical characteristics and biological effects on man make it a particularly hazardous substance. Also, it has received little regulatory attention during the half century in which it has been used.

This course is designed to meet the need for comprehensive and practical training in the special technical and regulatory problems associated with the control of radium. The schedule presents not only the overall problems and administrative aspects, but also the technical details. The Basic Radiological Health course or its equivalent is prerequisite. Topics included are:

- Administrative controls for radium
- Planning a State radium control program
- Registration and licensing of radium users
- Characteristics of radium and radon
- Medical and industrial uses of radium
- Radium incidents and accidents
- Instrumentation and survey methods for radium
- Leak testing of radium sources
- Radium decontamination

MANAGEMENT OF RADIATION ACCIDENTS (235)*

1 week

This course provides medical, engineering, and scientific personnel with knowledge of the potential hazards arising from accidents involving radiation. It also gives guidance for the management of these accidents. Because of the advanced nature of the program, Basic Radiological Health (211), or equivalent training or experience, is prerequisite.

Major attention is devoted to potential sources and types of accidents, preplanning, first-stage management and follow-up, and public relations. Selected accidents are reviewed in detail. Class and panel discussions enable the trainee to discuss specific problems with other class members, the training staff, and consultants. Field exercises may be scheduled, and trainees should bring clothing suitable for such activities. Agenda topics include:

- Sources and types of accidents:
  - Criticality
  - Reactor
  - Laboratory spills
  - Transportation
  - Weapons
- Preplanning and handling procedures
- Emergency exposure guides
- Contamination and decontamination
- Acute radiation syndrome
- Public relations and administrative aspects
- Psychological aspects
- Hazard liability

OPERATIONAL ASPECTS OF RADIATION SURVEILLANCE (236)*

2 weeks

This course is intended for engineers, scientists, and other professional personnel responsible for or interested in planning and conducting environmental radiation surveillance programs. Trainees obtain technical information and techniques necessary to perform the following procedures in a surveillance program: establish practical objectives; plan, organize and conduct a sampling program; interpret public health significance of surveillance data; and determine feasible control actions.

The course includes lectures and demonstration and problem sessions covering the movement of radionuclides through the environment from the source of emission to the sampling point. Training continues with considerations of air, food, and water sampling. Surveillance data is evaluated in terms of public health significance and public health action as outlined in reports of the Federal Radiation Council. All these subjects are correlated with the planning and conduct of surveillance programs. Analysis for radionuclides is covered only in relation to its effect on the selection of sampling procedures.

Because of the advanced nature of the training, the course, Basic Radiological Health (211), or equivalent training, is prerequisite. Course topics include:

- Sources of radionuclides in the environment
- Meteorological aspects of airborne radionuclides
- Distribution of radionuclides in the aquatic environment
- Radionuclides in food chains
- Statistical and judgment design of sampling programs
- Sampling techniques
- Statistical analysis of data
- Development and application of radiation protection standards
- Public health action

CHEMICAL ANALYSIS OF ENVIRONMENTAL RADIONUCLIDES (240)

2 weeks

This course is designed for professional laboratory personnel who measure radionuclides in milk, foods, and water by radiochemical analysis.

The principal objectives are to enable the trainee to: (1) conduct representative procedures for the determination of radionuclides of environmental significance; (2) initiate and develop a quality control program to insure the precision and accuracy of analytical results; and (3) evaluate radiochemical procedures as to their methodology and applicability to individual situations.

Instruction is given by lectures, demonstrations, and laboratory sessions (the last comprising approximately half the course). Since the course coverage includes only a brief review of radiation fundamentals, completion of the course, Basic Radiological Health (211), or equivalent training is prerequisite. Lecture topics include:

- Selection and preparation of standards
- Statistical considerations of counting data
- Quality control
- Low-level counting
- Liquid scintillation counting
- Preparation of foods for analysis
- Specific procedures for radiostrontium, radium, radioiodine, tritium and carbon-14
- Chemical simplification for gamma analysis

Laboratory exercises include:

- Determination of gross radioactivity in water
- Determination of radiostrontium in foods
- Determination of radium-226 by radon emanation
- Rapid methods for determination of radioiodine in milk and total radium

RADIONUCLIDE ANALYSIS BY GAMMA SPECTROSCOPY (208)*

2 week

This course is intended for professional personnel who measure environmental radioactivity. It enables the trainees to evaluate the performance of a gamma spectrometer and perform qualitative and quantitative analysis of environmental samples by gamma spectroscopy.

The course begins with instruction in the theory and operation of the gamma spectrometer. Presented next are the considerations necessary for the selection of a spectrometer and the procedures for evaluating its performance. Then follows a consideration of spectral analysis methods, including hand calculation and computer methods. During the course, a spectrometer is calibrated, and a 4 x 4 matrix system for milk analysis is developed. Extracurricular instruction can be made available for orientation to an analyzer system.

Completion of Basic Radiological Health (211) or equivalent training is prerequisite. Lecture topics include:

- Interaction of gamma rays
- The detector system
- Detector shielding
- Pulse height analyzer systems
- Display system
- Spectrum stripping methods
- Simultaneous equations methods
- Least squares methods
- Compton continuum subtraction
- Computer applications

Laboratory exercises include:

- Evaluation of linearity and stability
- Nuclide identification by energy and half-life
- Calibration of a spectrometer
- Analysis of air sample
- Analysis of milk sample

MEASUREMENT OF AIRBORNE RADIOACTIVITY (251)*

1 week

This course is intended for professional personnel responsible for measuring radioactive contaminants in air. It enables the trainee to collect a representative sample and perform the analysis necessary to determine the activity concentration of radionuclides in air, and evaluate environmental and occupational conditions.

Trainees receive instruction in the basic physics of air, the fundamentals of gas and aerosol behavior, instrumentation used in sampling gases and aerosols, analysis for gross radioactivity and for specific radionuclides, and the health implications of airborne radioactivity. Problem sessions and laboratory exercises supplement the lectures.

For those needing on-the-job training, arrangements can be made for several days of bench training immediately following the course. Laboratory experience, individually planned for the trainee, can be provided in such areas as: collection and identification of fission products from air samples, fabrication of organic-soluble filters and filter radioactivity standards, autoradiography, and fallout particle isolation. In addition, field trips may be arranged to local reactors and laboratories.

Completion of Basic Radiological Health (211) or equivalent training is prerequisite. Course presentations include:

- Radionuclides of interest
- Meteorology, atmospheric diffusion
- Fate of radionuclides in air
- Behavior of gases and aerosols
- Air sampling equipment and calibration
- Statistical considerations in establishing a sampling program
- Continuous monitors
- Preparation of air filters for analysis
- Principles of radiochemical procedures
- Gross analysis for beta radioactivity
- Selection and preparation of counting standards
- Sampling and analysis of airborne material for specific radionuclides including carbon-14, tritium, iodine-131, radon-222 and other noble gases
- Public health significance

INTRODUCTION TO AUTOMATIC DATA PROCESSING SYSTEMS (210)

1 week

To encourage understanding of automatic data processing among professional personnel assigned to radiological health programs, this course is presented by the Data Systems and Mathematics Section of the National Center for Radiological Health. Instruction covers the basic methods, techniques, and equipment associated with automatic data processing systems. This training lets the student assess more effectively the applicability to ADPS to the processing and analysis of radiological health data. Lecture topics include:

- History of data processing and computations
- Types of computers and systems components
- Computer operations and applications
- Basic concepts and techniques of systems analysis, design, and computer programming
- Management considerations in the acquisition and operation of an ADP installation

LIST OF COURSES

National Center for Air Pollution Control
Training Program

Number	Title
401	Atmospheric Survey
402	Source Sampling for Atmospheric Pollutants
403	Technical Orientation in Air Pollution
404	Source Sampling Techniques
405	Sampling and Identification of Aero Allergens
407	Medical and Biological Aspects of Air Pollution
408	Analysis of Atmospheric Organics
409	Analysis of Atmospheric Inorganics
411	Meteorological Aspects of Air Pollution
413	Control of Particulate Emissions
415	Control of Gaseous Emissions
416	Orientation in Air Pollution
420	Air Pollution Microscopy
421	Design of Source Sampling Trains
422	Elements of Air Quality Management
423	Diffusion of Air Pollution - Theory and Application
424	Community Air Pollution
425	Legal Aspects of Air Pollution
426	Air Pollution Data Evaluation
427	Combustion Evaluation - Sources and Control Devices
428	Public Information and Community Relations
429	Gas Chromatographic Analysis of Air Pollutants
430	Community Air Pollution - II
431	Air Pollution Control Technology
432	Special Topics in Air Pollution Microscopy
435	Atmospheric Sampling

Number	Title
439	Visible Emissions Evaluation
440	Special Topics in Air Quality Management
441	Special Topics in Process Evaluation and Control
442	Special Topics in (Atmospheric) Sampling and Analysis
443	Special Topics in Field Studies

For further information regarding course descriptions and presentation dates, write:

Chief, Training Program
National Center for Air Pollution Control
411 West Chapel Hill Street
Durham, North Carolina 27701

LIST OF COURSES

National Communicable Disease Center
Training Program

Number	Title
0110-G	Seminar Service for Professional Organizations
0130-G	Infectious Disease Symposia for Practicing Clinicians
1001-H	Tuberculosis Workshop for Public Health Nurses
1005-H	Tuberculosis Workshop for Clerical Personnel
1010-G	Principles of Epidemiology
1011-H	Clinical Management and Control of Tuberculosis
1021-H	Symposium: Rational Therapy and Control of Tuberculosis
1040-G	Epidemiology in Clinical Practice
1050-G	Infections Control in Hospitals and Institutions--Administrative
1120-G	Applied Epidemiology for Physicians
1200-G	Surveillance, Prevention, and Control of Hospital-Associated Infections
1201-G	Institutes for Nurses
1210-G	Principles of Epidemiology for Nurses
1211-G	Principles of Epidemiology for Nurses (field course only)
1220-G	Epidemiology: Concepts and Methods
1221-G	Principles and Applications of Epidemiology for Nurses
1410-G	Applied Epidemiology for Veterinarians
2010-A	Epidemiology and Control of Vector-Borne Diseases
2020-A	Techniques for Investigating Vector-Borne Diseases
2030-A	Control of Insects and Insect-Borne Diseases
2110-A	Control of Rodents and Rodent-Borne Diseases
2120-A	Rat Bite: Epidemiology and Control
2210-A	Insect and Rodent Control
2310-A	Control of Mosquitoes and Mosquito-Borne Diseases
2410-A	Identification and Biology of Arthropods of Public Health Importance
2420-A	Individual Training in Control of Vector-Borne Diseases and Disease Vectors
2430-A	Diseases in Nature Transmissible to Man
2440-A	Vector-Borne Diseases
2510-A	Control of Tick- and Mite-Borne Diseases
2653-N	Laboratory Tests in the Diagnosis of Pesticide Poisoning

Number	Title
2655-N	Pesticides and Public Health
2656-N	Principles of Chemical Epidemiology
2657-N	Operational Troubleshooting of Gas Chromatographic Systems
2658-N	Pesticide Residue Analysis by the Infrared Spectrophotometer
2659-N	Pesticide Residue Analysis by Electron Capture Gas Chromatographic System
2660-N	Principles and Practice of the Analytical Chemistry of Pesticides (Part 1. Review of the Chemistry of Pesticides and Ancillary Determinative Procedures)
2661-N	Principles and Practice of the Analytical Chemistry of Pesticides (Part 2. Analytical Instrumentation)
2662-N	Principles and Practice of the Analytical Chemistry of Pesticides (Part 3. Pesticide Isolation Procedures)
2710-A	Spotted Fever
2720-A	Tularemia
2730-A	Plague
2750-A	Arthropod-Borne Encephalitis
2770-A	Malaria
2800-A	Leptospirosis: Epidemiology and Control
3010-G	Environmental Sanitation
3011-G	Basic Mathematics for the Sanitarian
3012-G	Communicable Disease Control for the Sanitarian
3013-G	Insect and Rodent Vector Control
3014-G	Water-Borne Disease Control for the Sanitarian
3080-G	Epidemiology in Environmental Health
3090-G	Environmental Control in Health Care Facilities
3110-G	Epidemiology and Control of Food-Borne Disease
3120-G	Applied Procedures for the Control of Food-Borne Disease
3140-G	Epidemiology and Control of Salmonellosis
3230-G	Environmental Control of Communicable Diseases
3240-G	Administration in Environmental Health
3910-B	Microbiology of the Hospital Environment
4210-D	Nursing Work Conferences on the Control of Venereal Disease
4310-D	Venereal Disease Contact Interviewing
4540-DL	Current Laboratory Methods for the Diagnosis of Syphilis
4620-DL	Fluorescent Antibody and Culture Methods for Identification of *Neisseria gonorrhoeae*

Number	Title
4630-DL	Syphilis Serology Standardization Programs
4650-DL	Fluorescent Antibody Methods in the Diagnosis of Syphilis
4700-DL	Special Problems in Venereal Disease Laboratory Methods
6010-G	Training Methods -- Group- and Self-Instructional Techniques
6020-G	Coaching Practices
6030-G	Organization of In-service Training
6040-G	Planning, Presenting, and Evaluating In-service Training
6050-G	Evaluation of Training
6070-G	Development of Training Courses
6110-G	Preparation and Use of Training Aids
6120-G	Training-Aids Production - Advanced
6140-G	Preparation of Overhead Transparencies
6210-G	Training Methods and Aids
6310-G	Training for Instructors
6390-G	Involvement and Simulation Techniques
6421-G	How To Select and Use Programmed Self-Instructional Materials
6510-G	Personal Communications at Work
6610-G	Training Facilities - Design and Equipment
6620-G	Use of Automated Equipment in the Classroom
6630-G	Facilities for Learning - Design, Equipment, and Management
6850-G	Consultation Skills - Development and Use
6860-G	Personal Skills Training
7010-F	Communicable Disease Control - New Techniques and Developments
7120-F	Applied Epidemiology in Communicable Disease Control
7300-G	Environmental Aspects of Communicable Disease Control
7700-F	The Role of a Communicable Disease Center in International Ecology
8000-C	Laboratory Methods in Medical Parasitology (Part 1. Intestinal Parasites)
8010-C	Laboratory Methods in Medical Parasitology (Part 2. Blood Parasites)
8100-C	Individual Training in Complement Fixation (LBCF) Technique
8150-C	Laboratory Methods in General Medical Mycology
8151-C	Laboratory Method in Medical Mycology (Refresher)
8152-C	Laboratory Methods in Medical Mycology (Advanced)
8170-C	Laboratory Methods in Systemic Mycoses
8180-C	Individual Training in Mycology

Number	Title
8190-C	Laboratory Methods in the Diagnosis of Viral Exanthems
8200-C	Basic Laboratory Methods in Virology
8210-C	Individual Training in Virology
8230-C	Laboratory Methods in Enterovirology
8240-C	Laboratory Methods in Respirovirology
8250-C	Laboratory Methods in Arbovirology
8260-C	Laboratory Methods in the Detection of Rabies
8370-C	Laboratory Methods in Anaerobic Bacteriology
8380-C	Laboratory Methods in General Medical Bacteriology
8390-C	Laboratory Methods in Special Medical Bacteriology
8440-C	Principles and Bacterial Application of Fluorescent Antibody Techniques
8490-C	Isolation of Salmonella from Food Products and Animal Feeds
8499-C	Isolation and Preliminary Identification of Enteric Bacteria
8500-C	Laboratory Methods in Enteric Bacteriology
8550-C	Laboratory Methods in Medical Mycobacteriology
8580-C	Individual Training in Bacteriology
8610-C	Individual Training in Fluorescent Antibody Techniques
8620-C	Individual Training in Parasitology
8900-C	Basic Clinical Chemistry
8910-C	Clinical Chemistry Instrumentation
8940-C	Individual Training in Hematology
8950-C	Individual Training in Clinical Chemistry
8980-C	Human Blood Cell Morphology
9000-C	Individual Training in Central Services for Public Health Laboratories
9030-C	Individual Training in the Preparation of Biological Reagents
9100-C	Individual Training in Veterinary Public Health Laboratory Practices
9411-C	Individual Training in Serologic Methods in Microbiology
9420-C	Principles of Complement Fixation (General)
9421-C	Principles of Complement Fixation (Advanced)
9440-C	Laboratory Diagnosis by Serologic Methods (available Jan. 1969)

For further information regarding course descriptions and presentation dates, write:

Chief, Training Program
National Communicable Disease Center
Atlanta, Georgia 30333

CHRONOLOGICAL SCHEDULE OF COURSES

National Center for Urban and Industrial Health
Training Program

Date	Title
1968	
Aug. 19 - Aug. 23	Elements of Solid Waste Management (655)
Aug. 26 - Aug. 30	Statistical Method-Evaluation and Quality Control for the Laboratory (751)
Sept. 9 - Sept. 13	Milk Pasteurization Controls and Tests (302)
Sept. 9 - Sept. 13	Principles of Accidental Injury Control (475)
Sept. 16 - Sept. 20	Nursing Practices and Occupational Mental Health (532) (1st session) Indianapolis, Indiana
Sept. 16 - Sept. 20	Basic Environmental Statistics (801)
Sept. 16 - Sept. 20	Methods and Practices for Water Laboratory Survey Officials (242)
Sept. 16 - Sept. 27	Industrial Hygiene Engineering (501)
Sept. 23 - Sept. 27	Laboratory Analysis of Milk and Milk Products-I (300)
Sept. 30 - Oct. 4	Incineration - Principles of Design and Operation (675)
Oct. 14 - Oct. 18	Environmental Statistics - Design of Experiment (802)
Oct. 21 - Oct. 25	Methods and Practices for State Milk Laboratory Survey Officers (303)
Oct. 28 - Nov. 1	Solid Waste Handling - Field Evaluation (665)
Oct. 28 - Nov. 1	Special Analytical Techniques in Occupational Health (523)
Nov. 11 - Nov. 15	Safety in the Laboratory (480)
Nov. 13 - Nov. 15	Nursing Practices and Occupational Mental Health (532) (2nd session) Indianapolis, Indiana
Nov. 18 - Nov. 22	Heat Stress - Evaluation and Control (505)
Nov. 18 - Nov. 22	Laboratory Instrumentation and Quality Control (750)
Nov. 19 - Nov. 22	Laboratory Analysis of Milk and Milk Products-II (365)
Dec. 2 - Dec. 6	Administration and Supervision of an Occupational Health Nursing Service (533) (1st session)
Dec. 2 - Dec. 6	Environmental Statistics - Nonparametric (804)
Dec. 2 - Dec. 6	Sanitary Landfill - Principles of Design and Operation (670)
Dec. 2 - Dec. 6	Generating Community Action (420)
Dec. 9 - Dec. 20	Industrial Hygiene Engineering (501)

Date	Title
1969	
Jan. 6 - Jan. 10	Statistical Method-Evaluation and Quality Control for the Laboratory (751)
Jan. 13 - Jan. 17	Urban Noise - Effects, Evaluation, and Control (544)
Jan. 20 - Jan. 24	Microbiology of Drinking Water (240)
Jan. 20 - Jan. 24	Elements of Solid Waste Management (655)
Jan. 20 - Jan. 31	Industrial Hygiene Chemistry (502)
Jan. 27 - Jan. 31	Residue Analysis of Foods (311)
Feb. 10 - Feb. 14	Milk Pasteurization Controls and Tests (302)
Feb. 10 - Feb. 14	Principles of Accidental Injury Control (475)
Feb. 17 - Feb. 19	Administration and Supervision of an Occupational Health Nursing Service (533) (2nd session)
Feb. 24 - Feb. 28	Dust Evaluation Techniques (512)
Feb. 24 - Feb. 28	Incineration - Principles of Design and Operation (675)
March 3 - March 7	Environmental Statistics - Analyzing Qualitative Data (806)
March 10 - March 14	Institutional Sanitary Food Service (330)
March 10 - March 14	Shellfish Growing Area Survey Procedures (225) Dauphin Island, Alabama
March 10 - March 21	Industrial Hygiene Engineering (501)
March 24 - March 28	Occupational Health Nursing Practices and Chronic Disease Control (535) (1st session)
March 24 - March 28	Elements of Solid Waste Management (655)
March 24 - March 28	Chromatographic Analysis of Environmental Contaminants (316)
Apr. 7 - Apr. 11	Safety in the Laboratory (480)
Apr. 14 - Apr. 18	Sanitary Landfill - Principles of Design and Operation (670)
Apr. 14 - Apr. 25	Food Microbiology (310)
Apr. 21 - Apr. 25	Generating Community Action (420)
Apr. 28 - May 2	Ergonomics (543)
May 5 - May 8	Solid Waste Handling - Health and Safety (660)
May 12 - May 16	Administrative Aspects of Food Protection Programs (314)
May 19 - May 23	Basic Environmental Statistics (801)
May 19 - May 23	Laboratory Instrumentation and Quality Control (750)
May 26 - May 28	Occupational Health Nursing Practices and Chronic Disease Control (535) (2nd session)

Date	Title
1969	
May 26 - May 30	Statistical Method-Evaluation and Quality Control for the Laboratory (751)
June 2 - June 6	Technology of Food Protection (374)
June 9 - June 13	Environmental Statistics - Sample Size Determination (815)
June 23 - June 27	Environmental Statistics - Applied Regression Analysis (810)

COURSE DATES TO BE ANNOUNCED

Sanitary Control of Shellfish (221)

Shellfish Patrol Activities (222)

Administrative Aspects of Shellfish Sanitation (223)

Chemical Examination of Drinking Water (241)

Membrane Filter Techniques for the Bacteriological Examination of Drinking Water (245)

Chemical Chromatography (248)

Rare Organics in Drinking Water (249)

Unit Processes - Water Plant Operation (258)

Recent Developments in Water Plant Design (259)

Current Concepts in Food Protection (315)

Hospital Food Protection (333)

Sanitary Food Service (335)

Grade "A" Pasteurized Milk and Milk Products (363)

Egg Pasteurization Procedures (370)

Basic Housing Inspection (381)

Individual Water Supply and Sewage Disposal Systems (382)

Environmental Health Practice in Recreational Areas (383)

Orientation in Injury Control (401)

Introduction to Accidental Injury Control Programs (403)

Orientation in Occupational Health (509)

Electromagnetic Spectrum (521)

Evaluation of Laser Hazards (545)

Environmental Solid Waste Orientation (650)

Title

Composting Methods (680)

Environmental Statistics - Applied Probability (800)

Environmental Statistics - Survey Sampling (820)

Fundamentals of Data Processing (821)

Algebraic Compilers (822)

Assembly Language for the Honeywell-400 Computer (823)

Assembly Language for the IBM-1130 Computer - the IBM-1130 Disk Monitor System (824)

COBOL for the Honeywell-400 Computer (825)

Automatic Data Processing for Environmental Science Managers (827)

PERT for Environmental Science Managers (829)

Computational Analysis Techniques for Managers (897)

Computer Sciences Seminars (898)

Mathematical Science Seminars (899)

Rat Control in the Urban Environment (905)

Rat Prevention and Abatement in the Urban Environment (906)

For further information regarding course descriptions and presentation dates, write:

Chief, Training Program
National Center for Urban and Industrial Health
222 East Central Parkway
Cincinnati, Ohio 45202

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Budget Bureau No. 68-R657

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

PUBLIC HEALTH SERVICE

BUREAU OF DISEASE PREVENTION AND ENVIRONMENTAL CONTROL
NATIONAL CENTER FOR RADIOLOGICAL HEALTH
TRAINING AND MANPOWER DEVELOPMENT PROGRAM
ROCKVILLE, MARYLAND 20852

APPLICATION

I. **NAME OF APPLICANT:** MR. MRS. MISS

_____
(last) (first) (middle initial)

II. **COURSE DESIRED:**

Title _____ Course No. _____

Place where given _____ Dates _____

III. **PREVIOUS COURSES ATTENDED:**

Titles	Dates

IV. **SPONSOR OR EMPLOYER:**

Name of Organization or Firm _____

Address _____ . Phone _____

_____

V. **MAILING ADDRESS OF APPLICANT (If different from above):**

_____

_____

PHS-4995
4-67

(over)

VI. PROFESSIONAL STATUS:

Profession or Occupation _____

Position Title _____

Brief description of your present position _____

_____

_____

_____

VII. EDUCATION:

Number of years education completed beyond high school _____

College or University	Date attended	Major	Degree

VIII. PROFESSIONAL EXPERIENCE:

Total years experience in profession, including all public health experience _____

_____ _____

Signature of Approving Officer (Where applicable) Signature of Applicant

_____ _____

Title Social Security Number

_____

Date

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4-67

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Budget Bureau No. 68-R657

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

PUBLIC HEALTH SERVICE

BUREAU OF DISEASE PREVENTION AND ENVIRONMENTAL CONTROL
NATIONAL CENTER FOR RADIOLOGICAL HEALTH
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PHS-4995
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Title

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Signature of Applicant

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Social Security Number

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Form Approved
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DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

PUBLIC HEALTH SERVICE

BUREAU OF DISEASE PREVENTION AND ENVIRONMENTAL CONTROL
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TRAINING AND MANPOWER DEVELOPMENT PROGRAM
ROCKVILLE, MARYLAND 20852

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Titles	Dates

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Name of Organization or Firm _____

Address _____, Phone _____

_____

V. **MAILING ADDRESS OF APPLICANT (If different from above):**

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4-67

(over)

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Signature of Approving Officer (Where applicable) Signature of Applicant

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Title Social Security Number

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Date

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DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

PUBLIC HEALTH SERVICE

BUREAU OF DISEASE PREVENTION AND ENVIRONMENTAL CONTROL
NATIONAL CENTER FOR RADIOLOGICAL HEALTH
TRAINING AND MANPOWER DEVELOPMENT PROGRAM
ROCKVILLE, MARYLAND 20852

APPLICATION

I. **NAME OF APPLICANT:** MR. MRS. MISS

_____
(last) (first) (middle initial)

II. **COURSE DESIRED:**

Title _____ Course No. _____

Place where given _____ Dates _____

III. **PREVIOUS COURSES ATTENDED:**

Titles	Dates

IV. **SPONSOR OR EMPLOYER:**

Name of Organization or Firm _____

Address _____ Phone _____

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V. **MAILING ADDRESS OF APPLICANT (If different from above):**

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4-67

(over)

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Position Title _____

Brief description of your present position _____

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Signature of Approving Officer (Where applicable)

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Title

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Signature of Applicant

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Social Security Number

_____
Date

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DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

PUBLIC HEALTH SERVICE

BUREAU OF DISEASE PREVENTION AND ENVIRONMENTAL CONTROL
NATIONAL CENTER FOR RADIOLOGICAL HEALTH
TRAINING AND MANPOWER DEVELOPMENT PROGRAM
ROCKVILLE, MARYLAND 20852

APPLICATION

I. **NAME OF APPLICANT:** MR. MRS. MISS

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PHS-4995
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(over)

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Date

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DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

PUBLIC HEALTH SERVICE

BUREAU OF DISEASE PREVENTION AND ENVIRONMENTAL CONTROL
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Titles	Dates

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